Amendments

Please amend claims 1, 19, 23, 34, and 37 as set forth below. In accordance with current amendment practice, additions to the claims are shown by underlining. All claims are reproduced below:

1. (Currently Amended) A method for encoding a sequence of video frames comprising for each frame of the sequence of video frames:

(a) encoding said frame employing at least one controllable parameter; and

(b) adapting said encoding (a) of said frame when said frame is a still frame being non-intra encoded by said encoding (a), said still frame being determined prior to said encoding (a) and comprising a frame with certain content identical and unvarying to certain content of a preceding frame, wherein when said frame is being non-intra encoded said adapting including adjusting said at least one controllable parameter employed in encoding said still frame to disable motion estimation and limit motion compensation to minimize after decoding thereof, visually perceptible pulsation artifacts between still frames of a sequence of still frames within said sequence of video frames, wherein said still frame comprises one still frame of said sequence of still frames.

2. (Original) The method of claim 1, further comprising determining whether said frame comprises said still frame.

3. (Original) The method of claim 2, wherein each frame of the sequence of video frames comprises a plurality of pixels, and wherein each pixel of each frame comprises a multi-bit value and said determining comprises:

determining for a current frame (k+1) of the sequence of frames a summation statistic (PIX-SUM_{k+1}) derived from said multi-bit values of the plurality of pixels of the current frame;

determining a summation statistic ($PIX\text{-}SUM_k$) derived from the multi-bit values of the plurality of pixels of a prior frame (k) preceding the current frame (k+1) in the sequence of video frames; and

determining whether:

$$\left| PIX\text{-}SUM_k - PIX\text{-}SUM_{k+1} \right| < X$$

where X is a predefined value representative of a still frame.

4. (Original) The method of claim 3, wherein said determining further comprises:

determining an accumulated absolute difference derived from adjacent pixels of said plurality of pixels of the current frame ($PIX\text{-}DIFF_{k+1}$);

determining an accumulated absolute difference derived from adjacent pixels of said prior frame ($PIX\text{-}DIFF_k$); and

determining whether:

$$\left| PIX\text{-}DIFF_k - PIX\text{-}DIFF_{k+1} \right| < Y$$

wherein Y is a predefined value, and wherein said current frame is determined to comprise said still frame if both $\left| PIX\text{-}SUM_k - PIX\text{-}SUM_{k+1} \right| < X$ and $\left| PIX\text{-}DIFF_k - PIX\text{-}DIFF_{k+1} \right| < Y$ are true.

5. (Original) The method of claim 4, wherein said determining further comprises dividing the current frame and the prior frame into z corresponding regions, and wherein said determining comprises determining whether for each of said z corresponding regions:

$$\left| PIX\text{-}SUM_{kz} - PIX\text{-}SUM_{(k+1)z} \right| < X.$$

6. (Original) The method of claim 5, wherein $X = 256$, $Y = 256$, and $z \geq 4$, and wherein said four corresponding regions of said current frame and said prior frame comprise four horizontal bands.

7. (Original) The method of claim 2, further comprising determining whether said frame comprises a reference (I) still frame for said sequence of still frames and if so increasing a target bitrate to be used by said encoding (a) to encode said reference still frame.

8. (Original) The method of claim 7, wherein said increasing of the target bitrate for said reference still frame comprises detecting a subsequent B or P still frame in said sequence of still frames and moving target bits from said subsequent B or P still frame to said reference still frame.

9. (Original) The method of claim 8, wherein said moving of target bits comprises moving fifty percent of target bits for encoding said subsequent B or P still frame to encoding of said reference still frame.

10. (Original) The method of claim 2, wherein each frame comprises a plurality of macroblocks, and said method further comprises setting a zero motion vector mode ON upon determining that said frame comprises a still frame, and determining a predictive error for each macroblock of said still frame, and when said predictive error is less than a predetermined value, setting said predictive error to zero making said macroblock a skip macroblock.

11. (Original) The method of claim 10, further comprising calculating a quantization level (QL) for said skip macroblock for use in encoding said macroblock, and comparing the calculated quantization level (QL) to an average quantization level of a reference still frame (Av QL_{ref}) of said sequence of still frames and replacing said calculated quantization level with said average quantization level of said reference still frame when said calculated quantization level is less than said average quantization level of said reference still frame.

12. (Original) The method of claim 1, wherein when said frame comprises a still frame, said adapting (b) comprises defining a plurality of macroblocks in said still frame as skip macroblocks, and maintaining a minimum quantization level for encoding (a) of each skip macroblock of said still frame.

13. (Original) The method of claim 12, wherein said adapting (b) comprises maintaining said minimum quantization level for each skip macroblock of said still frame to be an average quantization level of a reference still frame (Av QL_{ref}) for said sequence of still frames.

14. (Original) The method of claim 2, wherein said frame comprises a plurality of macroblocks, and wherein said determining comprises determining whether said frame comprises a motion frame, and when so, said method further comprises for each of at least some macroblocks of said motion frame:

(i) determining whether said macroblock comprises a still macroblock;

(ii) encoding said macroblock employing at least one controllable parameter; and

(iii) adapting said encoding of said macroblock when said determining (i) determines said macroblock to be said still macroblock, said adapting including adjusting said at least one controllable parameter employed in encoding said still macroblock to minimize after decoding thereof, visually perceptible pulsation artifacts between corresponding still macroblocks of adjacent frames in said sequence of video frames.

15. (Original) The method of claim 14, wherein said adapting of said encoding comprises confirming that said still macroblock is other than an edge macroblock and is a non-intra macroblock, and that said frame comprises a P frame, and when confirmed, said method further comprises: determining that a motion vector for said still macroblock is zero and a macroblock difference (MBD) value is less than a predefined value, and when true, encoding said still macroblock as a skip macroblock and assigning a minimum quantization level to said skip macroblock.

16. (Original) The method of claim 15, wherein said assigning of the minimum quantization level comprises assigning an average quantization level for a reference frame for said P frame as quantization level for said skip macroblock.

17. (Original) The method of claim 14, wherein said adapting of said encoding comprising confirming that said still macroblock is other than an edge macroblock and is a non-intra macroblock, and that said frame comprises a B frame, and when confirmed, said method further comprises: determining that a motion vector for said still macroblock is equal to a motion vector of a previous macroblock in the B frame and that a macroblock difference (MBD) value is less than a predefined value, and if so, then encoding said still macroblock as a skip macroblock and assigning a minimum quantization level to said skip macroblock.

18. (Original) The method of claim 17, wherein said assigning of the minimum quantization level comprises assigning an average quantization level for a reference frame for said B frame as quantization level for said skip macroblock.

19. (Currently Amended) A method for encoding a frame of a sequence of video frames, said frame having a plurality of macroblocks, said method comprising for each of at least some macroblocks of said plurality of macroblocks:

(a) encoding said macroblock employing at least one controllable parameter; and

(b) adapting said encoding of said macroblock when said macroblock is a still macroblock being non-intra encoded by said encoding (a), said still macroblock being determined prior to said encoding (a) and comprising a macroblock with certain content identical and unvarying to certain content of a corresponding macroblock in a preceding frame, wherein when said macroblock is being non-intra encoded said adapting including adjusting said at least one controllable parameter employed in encoding said still macroblock to disable motion estimation and limit motion compensation to minimize after decoding thereof, visually perceptible pulsation artifacts between corresponding still macroblocks of adjacent frames in said sequence of video frames.

20. (Original) The method of claim 19, further comprising determining whether said macroblock comprises said still macroblock.

21. (Original) The method of claim 19, wherein said adapting of said encoding comprises encoding said still macroblock as a skip macroblock and assigning a minimum quantization level to said skip macroblock.

22. (Original) The method of claim 20, wherein said assigning of the minimum quantization level comprises assigning an average quantization level of a reference frame to said frame as said minimum quantization level for said still macroblock.

23. (Currently Amended) A system for encoding a sequence of video frames comprising:

a pre-encode processing unit, said pre-encode processing unit comprising:

a statistics measurement unit for use in determining prior to encoding whether a current frame of the sequence of frames comprises a still frame, said still frame comprising a frame with certain content identical and unvarying to certain content of a preceding frame;

a control unit for modifying at least one controllable parameter employed in non-intra encoding said still frame to disable motion estimation and limit motion compensation when said still frame is being non-intra encoded to minimize after decoding thereof, visually perceptible pulsation artifacts between still frames of a sequence of still frames when said statistics measurement unit determines said current frame to comprise said still frame; and

an encoding engine for non-intra encoding said current frame of the sequence of video frames using the at least one controllable encode parameter set by said pre-encode processing unit.

24. (Original) The system of claim 23, wherein said statistics measurement unit comprises means for determining whether said current frame comprises a reference still frame,

and if so, said control unit comprises means for increasing a target bitrate used by the encoding engine to encode said reference still frame.

25. (Original) The system of claim 24, wherein said means for increasing said target bitrate comprises means for transferring target bits from a subsequent still frame in a sequence of still frames to said reference still frame, said reference still frame also being in said sequence of still frames.

26. (Original) The system of claim 23, wherein each frame of said sequence of video frames comprises a plurality of macroblocks, and wherein said control unit of said pre-encode processing unit further comprises means for setting zero motion vector mode ON upon determining that said frame comprises a still frame, and means for determining a predictive error for each macroblock of said still frame, and for each macroblock of said still frame for setting its predictive error to zero making said macroblock a skip macroblock when its determined predictive error is less than a predetermined value representative of a still macroblock.

27. (Original) The system of claim 26, wherein said control unit further comprises means for maintaining a minimum quantization level for encoding each skip macroblock of said still frame.

28. (Original) The system of claim 27, wherein said means for maintaining comprises means for maintaining said minimum quantization level for each skip macroblock of said still frame at an average quantization level of a reference still frame (Av QL_{ref}) for said sequence of still frames.

29. (Original) The system of claim 23, wherein each frame of the sequence of video frames comprises a plurality of pixels, and wherein each pixel of each frame comprises a multi-bit value, and said statistics measurement unit comprises means for:

determining for a current frame (k+1) of the sequence of frames a summation statistic (PIX-SUM_{k+1}) derived from said multi-bit values of the plurality of pixels of the current frame;

determining a summation statistic ($PIX\text{-}SUM_k$) derived from the multi-bit values of the plurality of pixels of a prior frame (k) preceding the current frame (k+1) in the sequence of video frames; and

determining whether:

$$\left| PIX\text{-}SUM_k - PIX\text{-}SUM_{k+1} \right| < X$$

where X is a predefined value representative of a still frame.

30. (Original) The system of claim 29, wherein said control unit further includes means for:

determining an accumulated absolute difference derived from adjacent pixels of said plurality of pixels of the current frame ($PIX\text{-}DIFF_{k+1}$);

determining an accumulated absolute difference derived from adjacent pixels of said prior frame ($PIX\text{-}DIFF_k$); and

determining whether:

$$\left| PIX\text{-}DIFF_k - PIX\text{-}DIFF_{k+1} \right| < Y$$

wherein Y is a predefined value, and wherein said current frame is determined to comprise said still frame if both $\left| PIX\text{-}SUM_k - PIX\text{-}SUM_{k+1} \right| < X$ and $\left| PIX\text{-}DIFF_k - PIX\text{-}DIFF_{k+1} \right| < Y$ are true.

31. (Original) The system of claim 23, wherein when said current frame comprises other than said still frame, said control unit further comprises means for adapting encoding each of at least one macroblock of said current frame when said macroblock comprises a still macroblock, said means for adapting including means for adjusting said at least one controllable parameter employed in encoding said still macroblock to minimize after decoding thereof, visually perceptible pulsation artifacts between corresponding still macroblocks of adjacent frames in said sequence of video frames.

32. (Original) The system of claim 31, wherein said means for adapting comprises means for confirming that said still macroblock is other than an edge macroblock and is a non-

intra macroblock, and that said frame comprises a P frame, and wherein said control unit further includes means for determining that a motion vector for said still macroblock is zero and a macroblock difference (MBD) value is less than a predefined value, and when true, said encoding engine further comprises means for encoding said still macroblock as a skip macroblock having a minimum quantization level defined by a quantization level of a reference frame for said P frame.

33. (Original) The system of claim 31, wherein said means for adapting comprises means for confirming that said still macroblock is other than an edge macroblock and is a non-intra macroblock, and that said frame comprises a B frame, and wherein said control unit further comprises means for determining that a motion vector for said still macroblock is equal to a motion vector of a previous macroblock in the B frame and that a macroblock difference (MBD) value is less than a predefined value, and when true, said encoding engine further comprises means for encoding said still macroblock as a skip macroblock having a minimum quantization level to said skip macroblock, defined by a quantization level of a reference frame for said B frame.

34. (Currently Amended) A system for encoding a macroblock of a plurality of macroblocks of a frame in a sequence of video frames, said system comprising:

an encoding engine for encoding said macroblock of said frame using at least one controllable encode parameter; and

means for adapting said encoding of said macroblock when said macroblock is a still macroblock <u>being non-intra encoded by said encoding engine</u>, said still macroblock being determined prior to receipt of the still macroblock at the encoding engine, and comprising a macroblock with certain content identical and unvarying to certain content of a corresponding macroblock in a preceding frame, <u>wherein when said macroblock is being non-intra encoded</u> said adapting including means for adjusting said at least one controllable parameter employed in encoding said still macroblock to disable motion estimation and limit motion compensation to minimize after decoding thereof,

visually perceptible pulsation artifacts between corresponding still macroblocks of adjacent frames in said sequence of video frames.

35. (Original) The system of claim 34, further comprising means for determining whether said macroblock comprises said still macroblock.

36. (Original) The system of claim 35, wherein said means for adapting of said encoding comprises means for adjusting encoding of said still macroblock to encode said still macroblock as a skip macroblock and to encode said skip macroblock with a minimum quantization level defined by a quantization level of a reference frame to said frame having said still macroblock.

37. (Currently Amended) A computer program product comprising a computer usable medium having computer readable program code means therein for use in encoding a sequence of video frames, said computer readable program code means in said computer program product comprising for each frame of the sequence of video frames:

computer readable program code means for causing a computer to affect determining, prior to encoding, whether said frame comprises a still frame, said still frame comprising a frame with certain content identical and unvarying to certain content of a preceding frame;

computer readable program code means for causing a computer to affect non-intra encoding said frame employing at least one controllable encode parameter; and

computer readable program code means for causing a computer to affect adapting said encoding of said frame when said determining determines said frame to be said still frame being non-intra encoded, wherein when said frame is being non-intra encoded said adapting including adjusting said at least one controllable parameter employed in encoding said still frame to disable motion estimation and limit motion compensation to minimize after decoding thereof, visually perceptible pulsation artifacts between still frames of a sequence of still

frames within said sequence of video frames, wherein said still frame comprises one still frame of said sequence of still frames.

38. (Original) The computer readable program code means of claim 37, wherein said computer readable program code means for causing a computer to affect determining comprises computer readable program code means for causing a computer to affect determining whether said frame comprises a reference (I) still frame for said sequence of still frames, and when so, said computer readable program code means for causing a computer to affect adapting comprises computer readable program code means for causing a computer to affect increasing a target bitrate to be used by said encoding to encode said reference still frame by moving target bits from at least one subsequent still frame of said sequence of still frames to said reference still frame.

39. (Original) The computer readable program code means of claim 38, wherein each frame of said sequence of video frames comprises a plurality of macroblocks, and wherein said computer readable program code means for causing a computer to affect adapting comprises computer readable program code means for causing a computer to affect setting a zero motion vector mode ON upon determining that said frame comprises said still frame, and for determining a predictive error for each macroblock of said still frame, and when said predictive error is less than a predetermined value, for setting said predictive error to zero making said macroblock a skip macroblock.

40. (Original) The computer readable program code means of claim 39, wherein said computer readable program code means for causing a computer to affect adapting comprises computer readable program code means for causing a computer to affect maintaining a minimum quantization level for encoding each skip macroblock of said still frame, wherein said minimum quantization level comprises an average quantization level of a reference still frame for said sequence of still frames.

41. (Original) The computer readable program code means of claim 37, wherein said frame comprises a plurality of macroblocks, and wherein said computer readable program code

means for causing a computer to affect determining comprises computer readable program code means for causing a computer to affect determining whether said frame comprises a motion frame, and when so, said computer readable program code means further comprises for each of at least some macroblocks of said motion frame:

computer readable program code means for causing a computer to affect determining whether said macroblock comprises a still macroblock;

computer readable program code means for causing a computer to affect encoding said macroblock employing at least one controllable parameter; and

computer readable program code means for causing a computer to affect adapting said encoding of said macroblock when said macroblock comprises said still macroblock, said adapting including adjusting said at least one controllable parameter employed in encoding said still macroblock to minimize after decoding thereof, visually perceptible pulsation artifacts between corresponding still macroblocks of adjacent frames in said sequence of video frames.